

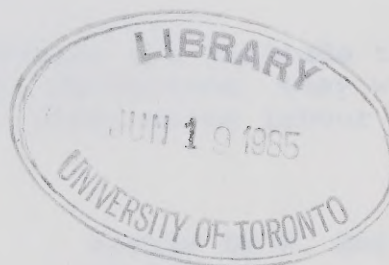
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Technical Study 34  
**GENERIC SKILLS: IMPROVING  
TRANSFERABILITY IN  
OCCUPATIONAL TRAINING**

Arthur Smith  
July 1981



This is one in a series of technical studies prepared for the Task Force on Labour Market Development. The opinions expressed are those of the author and do not necessarily reflect those of the Task Force. They do not reflect the views of the Government of Canada.



## THE QUESTION OF " I F "

If workers in different occupations use many of the same technical skills, then separate occupational training or development programs and unique occupational credentials are inefficient and wasteful both for national employment policies and for the workers concerned.

If out-of-work people cannot get jobs which they have the skills to perform because they have the wrong credentials, the system is harmful to the individuals.

If the Canada Employment and Immigration Commission has many out-of-work clients who cannot be placed because of credential rather than skill deficiencies, then the system is harmful to the nation as well as to the individual.

If employers cannot maximize the resources of their employees because of artificial credential restraints, then the system is harmful to productivity.


If guilds, unions and occupational associations tend to stress the uniqueness of separate occupations and to deny entry for reasons other than skill deficiencies, then the system is not working in the interests of national human resource development.

If workers are denied experience in allied occupations for artificial reasons, then the system is working against career growth in the individual.

If students in skill training programs develop the attitude that they are only qualified for entry into a single occupation, they will be ill-prepared for technological change and fluctuating labour markets.

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1980





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Professional and technological training is based on the assumption of a wide range of common skill needs. In contrast, nearly all vocational training is occupationally specific. There has rarely been any attempt to determine a common curriculum. Consequently, the more specific training related to one occupational program is needed, and graduates are expected to provide only the occupation-related skills. If they cannot find work in that trade, the likelihood of unemployment.

Research on the transferability of skills across occupations that have existed indicates that this can be done. A study in Canada, the United States and Great Britain, conducted in 1970, found that the transferability of skills across occupations was high. The study found that the transferability of skills across occupations was high. The study found that the transferability of skills across occupations was high. The study found that the transferability of skills across occupations was high.

Traditional occupational training programs have been criticized for their lack of transferability. The study found that the transferability of skills across occupations was high. The study found that the transferability of skills across occupations was high. The study found that the transferability of skills across occupations was high.



## ABSTRACT

### GENERIC SKILLS: IMPROVING TRANSFERABILITY IN OCCUPATIONAL TRAINING

Arthur Smith

This paper discusses the concept of generic skills -- skills common to a number of occupations -- and its implications with respect to trades training and occupational mobility.

Professional and technological training is based on the assumption of a wide range of common skill needs. In contrast, nearly all vocational training is occupationally specific. There has rarely been any attempt to determine a common curriculum. Consequently, trainees cannot transfer from one occupational program to another, and graduates are expected to practise only the occupation trained for. If they cannot find work in that trade, the alternative is unemployment.

Research and the few generically based training programs that have existed indicate that this need not be the case. Studies in Canada, the United States and West Germany have noted an extremely high percentage of skills common to many trades. Generalized training courses have been highly successful in equipping trainees to enter a range of occupations. However, the educational, training, counselling and placement systems continue to treat trades as unique and separate.

Traditional occupational classification methods exacerbate the problem. They tend to be based on industrial sectors and vertical progression within an industry, and do not recognize skills common to trades within a range of industries.





Classification based on transferable skills would recognize the abstract abilities (e.g., mathematical, communications, interpersonal, reasoning, manipulative) and job-related skills (e.g., clerical, cleaning, collecting, service, assembly, maintenance) common to a range of occupations. This classification could be used to develop skill clusters with important applications for training and placement, enhancing the possibilities for occupational mobility and substitutability.

Occupational mobility refers to the ability of persons trained in one occupation to move to another with little or no additional instruction. Occupational substitutability refers to employment and training programs based on occupational mobility -- e.g., to place unemployed workers from surplus occupations who could fill vacancies in other, high-demand occupations; or to design training programs building on the existing skills of unemployed workers.

The clustering concept would make training more efficient and economical. Instructors could be specialized by type of skills imparted, rather than by occupation. Training counsellors would have a more flexible role, since students could transfer after entering a program. Training institutions could adapt more easily to changing labour demand, since the occupationally specific elements of training would be smaller.

While current training programs could be greatly enhanced by application of the generic-skills concept, other barriers to occupational mobility must also be recognized. These include such factors as artificial prerequisites to employment and training programs and the limiting aspects of licenses, apprenticeship programs, accreditation, and union practices that restrict movement from one trade to another





and movement within occupational classification systems. Ignorance about occupational mobility opportunities is another important barrier. Trainees, trades workers, instructors, counsellors, employers and others must become more aware of the possibilities for occupational mobility.

The paper concludes with a number of recommendations for government policy.



## SOMMAIRE

### COMPÉTENCES GÉNÉRIQUES: AMÉLIORATION DE LA TRANSFÉRABILITÉ DANS LA FORMATION PROFESSIONNELLE

Arthur Smith

Cette étude traite de la notion de compétences génériques - c'est-à-dire communes à un certain nombre de professions - et à leur incidence sur la formation dans les métiers et sur la mobilité professionnelle.

La formation professionnelle et technologique présuppose l'existence de toute une gamme de besoins communs en compétences. En revanche, presque toute la formation dans les métiers est axée sur les tâches à accomplir. On a rarement essayé d'établir un programme d'études commun. Par conséquent, les stagiaires ne peuvent passer d'un programme à un autre, et les finissants sont censés n'exercer que la profession pour laquelle ils ont été formés. S'ils ne peuvent trouver du travail dans ce métier, il ne leur reste plus que le chômage.

Des travaux de recherche et les quelques programmes de formation de base mis en oeuvre par le passé indiquent qu'il n'est pas nécessaire qu'il en soit ainsi. Des études effectuées au Canada, aux États-Unis et en Allemagne de l'Ouest ont relevé un pourcentage extrêmement élevé de compétences communes à bien des métiers. Des cours de formation générale ont permis dans une large mesure d'ouvrir aux stagiaires toute une gamme de professions. Cependant, les systèmes d'enseignement, de formation, d'orientation et de placement continuent de considérer les métiers comme uniques et distincts.

Les méthodes traditionnelles de classification professionnelle aggravent le problème. Les classifications se font en général par secteur d'activité et selon la hiérarchie professionnelle et ne tiennent pas compte des





compétences communes aux métiers de toute une série de secteurs d'activité.

Une classification fondée sur des compétences transférables tiendrait compte des aptitudes abstraites (par exemple, mathématiques, communications, relations interpersonnelles, logique et flexibilité manipulative) et des compétences liées aux emplois (par exemple, travail de bureau, nettoyage, rassemblement de données, services, montage et entretien) communes à toute une série de professions. Cette classification pourrait permettre des regroupements de compétences et avoir des applications importantes pour la formation et le placement, favorisant ainsi les possibilités de mobilité et de substitution professionnelles.

On entend par mobilité professionnelle l'aptitude des gens formés dans une profession à en exercer une autre, la formation supplémentaire nécessaire étant alors minime ou superflue. La substitution professionnelle renvoie à l'emploi et aux programmes de formation fondés sur la mobilité professionnelle; par exemple, il s'agirait de déplacer les chômeurs des professions où il y a un excédent de main-d'oeuvre et de leur permettre, le cas échéant, d'exercer d'autres professions où la demande est élevée ou de concevoir des programmes de formation faisant appel aux compétences que possèdent déjà les chômeurs.

La notion de regroupement pourrait rendre la formation plus efficace et plus économique: les moniteurs pourraient être spécialisés selon le genre de compétences nécessaires plutôt que selon la profession; les conseillers en formation auraient une plus grande marge de manoeuvre, car les étudiants pourraient changer de programme. De plus, les établissements de formation pourraient s'adapter plus





facilement à l'évolution de la demande de main-d'oeuvre puisque les composantes de la formation axée sur des professions particulières seraient moins nombreuses.

Les programmes de formation actuels pourraient être grandement améliorés par l'application de la notion de compétences génériques, mais il faut également tenir compte d'autres obstacles à la mobilité professionnelle. Notons entre autres les conditions préalables et artificielles à l'emploi et à l'admission aux programmes de formation, les limites imposées à l'obtention de permis, aux programmes d'apprentissage et à la certification, ainsi que les pratiques syndicales qui restreignent la mobilité de travailleurs d'un métier à un autre et au sein des systèmes de classification professionnelle. L'ignorance en matière de mobilité professionnelle représente un autre obstacle important. Les stagiaires, les gens de métier, les moniteurs, les conseillers, les employeurs et les autres intéressés doivent être davantage sensibilisés aux possibilités qu'offre la mobilité professionnelle.

En conclusion, l'étude présente une série de recommandations pour les fins de la politique gouvernementale.



## SKILL TRANSFERABILITY - FACT OR FANCY

### PROFESSIONS AND TECHNOLOGIES

Historically, much of the content of professional education offered at the university level has been based on the assumption of universality of needs. Undergraduate students aspiring to become engineers find themselves taking many of the same credit courses as are being taken by would-be doctors, lawyers, geographers and counsellors. The students quickly become aware of these communalities (shared similarities, e.g., secretaries and mechanics both fill in forms) of skills and knowledge attained and are thus enabled to alter their educational goals, frequently without changing the time frame required to obtain their degrees. Even after graduation they find that many job vacancies at the professional level may be filled by qualified people from a variety of disciplines. Job specifications and advertisements frequently cite a number of different degrees which are considered acceptable and even, in many cases, merely require something like, "Graduate of Post Secondary Education", or "University Graduate." If one were to select, at random, ten officers of the Canada Employment and Immigration Commission, it would be extremely difficult to determine from the work which they carry out, the specific disciplines in which they had received their training. Thus, with the exception of the highly specialized job requirements and those requiring a specific licence to practice, the statements at the beginning of this monograph are not generally applicable to people with professional training.

Similarly, the curriculum content for many technical and technological two-and three-year programs, offered by colleges and technical institutes, contain many common subjects or courses. However, graduates of these programs





tend to be highly specialized and are frequently licensed. Thus, occupational mobility is not nearly as prevalent as with university graduates.

### TRADES

Despite the fact that professional and technological training is, wherever possible, based on the assumption of universality of needs, nearly all vocational training tends to be occupationally specific. Carpentry instructors teach their students blueprint reading, plumbing instructors all teach their students blueprint reading, and electrical instructors teach blueprint reading. Rarely has there been any attempt to determine common curriculum content for the trades. Why is this so? Is it because the blueprint reading required by the different trades is significantly different? The writer once supervised a study of the construction trades and found that over 80% of the skills being taught in blueprint reading and sketching were common requirements. From this and similar studies that have been carried out it is evident that we must look elsewhere for the answer to the apparent assumption of the uniqueness of needs in vocational education. The author suspects that this phenomenon has occurred simply because most vocational instructors were previously trades people who were hired to develop and run a specific trades course. Because they have been operating within a system of one instructor - one trades course, the notion or desirability of identifying common skills, subjects or topics has rarely arisen.

Two logical consequences have arisen by this approach:

- Students who find that they have selected, or have been selected for, an unsuitable training course find that the system does not permit them to move from one



training course to another. They have only two alternatives. One, to drop out of the course and hope that in some future year they may get a seat on a more appropriate course. Two, to stick with the course, regardless of the fact that they, or their instructors, have found that they are ill-suited for employment in the occupation for which they are receiving training.

- The graduates of these training programs know they are well-qualified for work in the area for which they have been trained but rarely consider whether or not their hard-earned skills might be useful in some alternative occupation. It is ironic that a civil engineer after four years of training, is expected to be knowledgeable and to some degree skillful in fields such as electricity, plumbing and carpentry, but the trades people, also after up to four years apprenticeship training, are supposed to be skillful and knowledgeable only in their specific fields.

As a direct result of this belief in uniqueness of trades skills, neither the individual concerned nor the system has recognized that a person qualified in one trade could well be usefully employed in an alternative trade. An unemployed millwright, for example, looks only for jobs as millwright and, failing to find such a job, seeks unemployment insurance, which under the circumstances would most likely be granted. However, this millwright would have acquired skills, such as operating machine lathes, that could well be used in machine shops where jobs are plentiful. The result: a further depletion of UIC funds a once proud millwright on unemployment insurance who would rather be gainfully employed, a decline in the nation's productivity, and an employer still looking for a qualified machinist.





## THE EVIDENCE OF TRADE TRANSFERABILITY

Is the above scenario factful or fanciful? Is the system that considers each vocational trade unique, correct or is it erroneous? Where is the evidence? Research in this field has been limited, but the author will attempt to summarize some projects and events which tend to be persuasive:

A number of years ago many of the provincial training institutions, with the active collaboration of the then Department of Manpower and Immigration, decided to offer generalized training courses for clients with aspirations in the clerical and accounting fields. These programs, frequently called Commercial Training, have been highly successful and the graduates look for and receive jobs in a large variety of occupations -- such as clerks, clerk-typist, secretaries, bookkeepers, bookkeeping clerks, keypunch operators, cashiers, tellers and junior accountants. It is apparent from the success of these programs that there is much communality of requirements.

- Saskatchewan NewStart Corporation ran a series of courses for Life Skills Coaches to satisfy the needs for educational institutions who wanted to offer Life Skills Courses. So many of the graduates were offered and accepted positions other than Life Skills Coaches, that the corporation had to train nearly double the number of coaches required. It was obvious that these graduates were able to transfer their acquired skills to occupations other than those for which they had been trained.
- The Canadian Armed Forces, which offers a total career program, have frequently had to remuster people into



different trades, either because the trade had become redundant through changes in weaponry or because the individual concerned had become medically unfit for a field trade and had to be changed to a more sedentary trade. They found that, although it takes years to develop full competency in the initial trade, the remustered people required only months to become competent in the new trade. Obviously these people had learned skills and knowledge in the first trade that were transferred to the second trade.

- The German Federal Manpower Commission has carried out a series of studies to determine occupational substitution and occupational mobility. In one particular study (Hofbauer and Konig, 1972) in which the supervisors of 0.5% of all gainfully employed males were questioned it was found, "For nearly half of the posts held by gainfully employed males, which in the judgement of superiors, require some type of occupational training involving a phase of theoretical instruction, at least two different skilled occupations, in the judgement of superiors, can be considered." Table 2 from the referenced report gives evidence that, "...in the judgement of superiors, the individual posts classified according to the primary occupations are polyvalent to a high varying extent, and thus can be filled by persons having diverse occupational skills."
- Training Research and Development Station carried out a series of studies (Smith, 1975) to determine the occupational requirements for academic skills (Mathematics, Communications, Reasoning and Interpersonal). Data were collected from workers and supervisors in 77 different occupations. The results





- 6 -  
Percentage of alternative skilled occupations designated by superiors  
in the case of selected primary skilled occupations\*

Primary Skilled occupations	Percentage of instances in which alternatives were designated							Average frequency specific alternative
	10	20	30	40	50	60	70	
Farmer	27.2							1.1
Gardener	22.2							1.1
Forester	20.8							1.1
Miner	35.7							1.1
Mason et al	32.1							1.1
Concrete Former et al	69.1							1.1
Carpenter	56.9							1.1
Roofer	15.5							1.1
Highway Construction Worker et al	53.4							1.1
Plasterer	39.3							1.1
Tiler	34.7							1.1
Painter & Varnisher et al	12.5							1.1
Moulder	23.7							1.1
Lathe Operator et al	55.5							1.1
Welder (autogenous process)	61.5							1.1
Wrought Iron Worker et al	71.3							1.1
Toolmaker et al	65.2							1.1
Locksmith, Sheet Metal Worker, Machinist et al	65.0							1.1
Structural Steel Worker	67.9							1.1
Tinsmith et al	57.7							1.1
Tinsmith-Plumber	49.1							1.1
Plumber et al	63.3							1.1
Mechanic et al	73.1							1.1
Automotive Mechanic	48.5							1.1
Precision Mechanic et al	65.5							1.1
Electrician et al	35.5							1.1
Telecommunications Technician et al	62.5							1.1
Electrical Power & Control Technician et al	60.4							1.1
Radio & TV Technician et al	51.1							1.1
Chemical Engineering Technician et al	44.1							1.1
Joiner et al	33.0							1.1
Typesetter	19.0							1.1
Printer et al	20.9							1.1
Weaver et al	23.6							1.1
Tailor (mens' or womens' wear)	9.4							1.1
Interior Decorator et al	35.3							1.1
Baker	25.2							1.1
Butcher	5.1							1.1
Cook	20.2							1.1
Laboratory Technician et al	30.9							1.1
Draftsman	4.1							1.1
Retail Merchant, salesman et al	45.1							1.1
Bank Clerk	42.4							1.1
Insurance Agent	5.1							1.1
Freight Forwarding Agent et al	44.5							1.1
Letter-Carrier	19.6							1.1
Commercial or Industrial Clerk et al	41.9							1.1
Other categories and those for which no data is available	35.0							1.1
Totals	40.1							1.1

Only those skilled occupations were included in the Table which were designated as primary in 20,000 instances (extrapolation). They account for 82.1% of all instances.



clearly established that over half of the skills surveyed were common occupational requirements. It is therefore logical to assume that they are transferable to alternative occupations. The remaining skills were either infrequent requirements or tended to cluster by groups of occupations.

- The Center for Vocational Education of Ohio State University carried out a series of studies, commissioned by the U.S. Department of Health, Education and Welfare, to determine what schools should be teaching to all students to improve their chances of adapting to new jobs when a job change is desirable or necessary (Ohio State uses the word "job" where CEIC would use the word "occupation"). In a report prepared for OECD, Pratzner and Stump (1977) summarized a number of conclusions of which the following are extracts:

There are easily identifiable skills, abilities and characteristics that are useful for a variety of occupations....These skills and abilities include more than the traditional basic reading, writing, and computation subjects taught in schools. A considerable amount of research has been done to identify these as they relate to specific occupations. Only a few efforts have attempted to develop new clusters or groupings of occupations based on these similar characteristics. Several alternatives are available for studying individuals' career paths in ways that might improve our understanding of how skills and abilities are important. As yet, however, almost no research has been done in this area. Our notions of career job titles in industrial sectors....Lack of knowledge and barrier to facile adaptation to new job situations...Having transferable skills can facilitate occupational adaptability. To the extent that individuals perceive similarity among jobs and are able to transfer their skills and abilities effectively, the time and costs associated with supplemental training should be reduced, reflecting a savings to employers and individuals alike...All skills are potentially transferable to some extent. Thus the process of transfer, and especially





the teaching for transfer, is of paramount importance for education... It seems desirable that students be provided with opportunities to practice the application of skills and abilities in a variety of conditions and situations. Transfer should be a deliberate and explicit objective of all instruction so that students are made aware of the multiple uses of their skills and abilities."

- Canada Employment and Immigration Commission (CEIC) carried out a survey (1979) (a) 1600 workers in 131 occupations, mostly craft trades, using a questionnaire which measured the use of 588 trade tools, including portable hand tools, powered hand tools, test and diagnostic tools, shop machinery and equipment, wheeled vehicles, heavy mobile equipment, and associated safety processes. The results were quite dramatic and clearly indicate that, at least in the trades surveyed, the workers share a phenomenally high degree of tool skills.

Figure 1 illustrates the percentage of skills which some of the occupational workers use of the skills required in the corresponding occupations. The millwright, for example, uses 94% of the skills of a maintenance machinist. Despite the fact that this survey did not cover trade knowledge or trade tasks, it appears patently ridiculous to assume that a millwright who desires to be employed as a machinist should have to start at ground zero on a three- to five-year training program.



FIGURE 1 - Percentages of tool skills workers in the undernoted occupations use of the skills required by the occupations at the right.												
	Aircraft Mech.	Boilerhouse Rep.	Const. Eqpt. Mec.	Diesel Mech.	Elec. Repairer	Maint. Mach.	Millwright	Pipe Fitter	Plumber	Power. Rep.	Refrig. Mech.	Welder, Com.
Aircraft Mechanic		90	95	96	96	92	91	89	90	90	96	94
Boilerhouse Repairer	90		96	98	99	92	91	93	95	94	97	94
Const. Eqpt. Mechanic	95	96		93	88	84	81	78	79	82	89	88
Diesel Mechanic	96	98	93		90	86	83	81	84	84	91	89
Electrical Repairer	96	99	88	90		81	80	82	84	82	91	87
Maint. Machinist	92	92	84	86	81		94	87	87	86	89	96
Millwright	91	91	81	83	80	94		90	91	87	90	98
Pipe Fitter	89	93	78	81	82	87	90		93	88	91	90
Plumber	90	95	79	84	84	87	91	93		85	89	86
Powerhouse Repairer	90	94	82	84	82	86	87	88	85		96	94
Refrigeration Mech.	96	97	89	91	91	89	90	91	89	96		84
Welder, Combination	94	94	88	89	87	96	98	90	86	94	84	

- The CEIC survey also confirmed, as was suggested by the Ohio Studies, that the traditional industrial classifications of occupations do not necessarily cluster occupations together based upon similar characteristics (other than the characteristics of working together or in the same industrial field). One report (Employment and Immigration Canada, 1979) (b) shows that automotive machinists and maintenance machinists have more skills in common with the mechanic trades than with the machinists with whom they are classified. Similarly, the body repairers, who are traditionally classified



with the mechanics, have more in common with the metal working trades. Trade classification systems have evolved from the various industries with little attempt to develop families of occupations based on similar characteristics. Thus, the radiographer industrial, is classified in Chapter 99 of the CCDO and not with the diagnostic-radiological technician and the radiotherapy technician, who are classified in Chapter 31. It appears that the medical industry wanted to keep all their occupations together and thus the major separation of occupations which would appear to share many common skills.

The evidence appears clear that the vocational trades are as likely to share common skills and other attributes as are the professional occupations. Yet the educational, training, counselling and placement systems continue to treat the vocational trades as uniquely different. Why?

BUT! BUT! BUT! BUT!

The following is a summary of the arguments most frequently used to preserve the status quo:

- The Union Bugaboo. Countless times I have heard the following or a similar statement, "Great idea Mr. Smith, but the unions will never let it happen." Invariably this argument is used by government officials and educators. I have yet to hear a union representative argue that their union would be against the idea of skill transferability, and I have had union representatives at seminars and workshops dealing with the subject. Most union workers are sincerely dedicated to establishing and looking after the rights of union





members. Certainly there would be union problems which would have to be solved, particularly for closed-shop unions and in cases where the suggested transferability would involve two unions. It is, however, difficult for the author to believe, that with sincere negotiations, unions would not collaborate towards the development of a system which would enhance the job opportunities for their members. Certainly, history has shown that union representatives have worked hard and diligently to place workers into alternative occupations when their plants were closed.

- It's Not Our Responsibility (or Authority). Federal officials are extremely cautious when dealing with matters which might infringe on provincial constitutional rights. Many of the provinces have given autonomy to the training colleges and vocational schools and are hesitant to suggest curriculum changes. Colleges tend to give their trades instructors full authority for course content. Instructors believe that they are turning out people to meet the needs of industry. Industrial officials believe that it is a governmental problem and also are, rather naturally, not terribly interested in making their workers more occupationally transferable. The funding, instruction, testing and accreditation of apprentices involve the federal government, provincial departments of labour and education, training institutions and employers. Superimposed on these difficulties are the jurisdictional authorities which have been given to the CEIC regions and the legal authorities which provinces have given to occupational associations. A former U.S. President, Harry S. Truman, used to say, "The buck stops here!" It is difficult to ascertain where the buck



stops in terms of training and career development decisions, and even more difficult to understand, knowing of the billions of dollars which have been expended on employment training, how little real authority and leadership the funding agency has exercised over the content and quality of occupational education which is supposed to enhance job opportunities for Canadians. Even the modest Training Improvement Program, which did achieve a considerable degree of cooperation and collaboration, was exorcised as a budetary cut.

The above is obviously an over-reaction and was written only to demonstrate that there is a requirement for collaboration, cooperation, compromise and in particular, leadership, if any serious attempt is to be made to make any significant changes to the existing system. In fact, there are many officials at all levels who are genuinely interested in ensuring that workers acquire, and know they have acquired, skills that would enhance their opportunities when they wish to or are forced to make job or occupational changes. Many believe, and have suggested, that leadership in this area should come from the Employment and Immigration Commission.

• But the Problem in our (Province, Region, etc) is Different.

Educational and training officials seem to have a fixation that their secretaries and automotive mechanics require training different from those elsewhere in the nation and therefore require a tailored curriculum to suit their local needs. Yet the secretaries use the same IBM typewriters and the mechanics fix the same type





of Ford cars, regardless of where they work. Data from the generic skills studies carried out to date have failed to identify any provincial or regional differences in occupational skill requirements.

- But the Information is Incomplete. This is a valid criticism. The Ohio State University studies mainly concentrated on an exhaustive research of the literature. The German Federal Manpower Commission only tested the opinions of the supervisors and made no attempt to find the underlying reasons why transferability should or should not occur. The generic skills studies have only examined sets of skills and have not tested the requirements in a comprehensive array of skills, knowledge and tasks. If occupational mobility and substitutability is to be seriously addressed there is a need for a great deal more research including data collection, analysis and synthesis. This will be dealt with later in this monograph.

#### WHAT ARE TRANSFERABLE SKILLS?

The author has been wrestling, rather unsuccessfully, since the inception of the generic skills project, to articulate a clear definition of the word skill. Usually he gets around the problem by explaining that skills are those behaviours used by workers to perform job tasks and uses job tasks and uses examples such as a comparison of a carpenter performing the task of framing walls and the cabinet maker in the task of building office furniture. Both use skills such as measuring, reading drawings, reading work orders, accepting oral instructions, marking dimensions, cutting to fit, assembling and driving in nails (Smith,



Sept. 1980) Sjogren (1977) has the following to say about the word skill:

Skill is a term that is used in different ways and with different meanings. Some restrict its use to motor behaviors. Others include cognitive behaviors such as reading and mathematics skills. Social behaviors will also be included by some. Use of the term is further confounded by the fact that some will restrict its meaning to discrete acts and others will include complex behaviours in the definition. Many variations are reflected by the following definitions of skill:

1. Great ability or proficiency (Webster's dictionary, 1964)
2. An organized sequence of actions, proficiently executed and usually displaying a flexible but systematic temporal patterning (Krech and Crutchfield, 1958).
3. An individual's level of proficiency on a specific set of tasks (Cunningham, 1971).
4. Those behaviors which are fundamental to the performance of many tasks (Smith, 1975).

Each of these definitions reflects a common theme of proficiency. The claim that a person has a skill is taken to mean that the person is proficient in some behavior. The problem we have with these definitions and others is that the definitions do not provide a clear basis for distinguishing between a skill and a nonskill.

The conclusion we have made is that skill is not a definer of behavior in the sense that one behavior is a skill and another behavior is not a skill. It is difficult to think of any learned behavior with intellectual and/or psychomotor elements to which the term skill would not apply. Thus a skill can refer to any learned behavior.

The author is satisfied with Sjorgen's explanation but rather naturally refuses to change the title generic skills to generic learned behaviors!

There have been many studies carried out in an attempt to determine which skills are occupationally transferable. Unfortunately these studies vary greatly in terms of the different classification systems used, the levels of



specificity of expressing the skills, and the levels of abstractness used. It is therefore nearly impossible to attempt to integrate the results or conclusions of these studies. Sjorgen's monograph, previously cited, is worth studying for an analysis of the different studies. He finally selected the generic skills studies for his discussion on the question of skill transferability:

The Generic Skills Project used a 5-category classification scheme that is useful for discussion of skill transferability. We have attempted to summarize the review using this scheme.

1. MATHEMATICS SKILLS. In the area of mathematics, the evidence seems to be that skills through what is usually regarded as first year algebra are transferable across many occupational situations. Skills at a higher order are certainly transferable but to a much more restricted range of occupations.
2. COMMUNICATION SKILLS. To have some reasonable range of occupational options, a person should have skills in verbal and nonverbal forms of communications, written expression and comprehension, and speaking and listening. The level of development of these skills seems to be about what might be expected of a student in the secondary schools.
3. INTERPERSONAL SKILLS. There seems to be considerable overlap between this area and the communication skill area. Generally it would appear that a person should be able to carry on a conversation, give intelligible instructions to others, and generally be able to attend to others in a positive manner. The importance of interpersonal skills to worker success has been recognized increasingly in recent years, to the extent that many organizations provide extensive educational programs in this area. This is an area, however, that has received little emphasis in the regular educational programs. Thus, it is difficult to say at what level of proficiency high school graduates could be expected to have developed in interpersonal skills.
4. REASONING SKILLS. Estimation and information-seeking skills are important in this area and are given some emphasis in the schools. Other skills like setting priorities, determining alternatives, and planning are NOT emphasized as much. These skills do seem important, however, for a large number of





occupations. Perhaps the current educational/training systems do less in this area than in others.

5. MANIPULATIVE SKILLS. In the psychomotor/sensory area the skills apparently transferable to a large number of occupations seem to be those of sensory acuity, manual dexterity, and coordination. Some of these skills may be more genetically determined than those in the other areas. Skills in this area are amenable to training, however, and this is another area in which our current educational and training programs may be somewhat deficient.

The author is not satisfied with the above classification scheme as it exists now. It is incomplete and requires further clarification of the manipulative skill area. Skills such as sensory acuity, manual dexterity and coordination are too abstract either for data collection or for training purposes. The tool skill survey carried out by CEIC was one major attempt to identify and further clarify skills in this area. Recently the author has identified a number of additional skill areas including the following:

- Clerical skills which include filing, typing, posting or transcribing, recording and accounting, preparing budgets and forecasts, statistical analyses, handling money, checks and credit cards, ordering, receiving, storing and issuing stores, etc.
- Cleaning skills which include tidying, sweeping, mopping, washing, buffing, waxing, shining, sterilizing, etc.
- Collecting skills which include picking up stores or materials, moving or removing trash, items or stores, acting as a runner, etc.



- Service skills which include personal services such as informing, helping, observing, serving, comforting, etc., and building or property services such as guarding, tending, inspecting, etc.
- Assembly skills which include the design, layout, machine set-up and repetitive operations to assemble or manufacture items.
- Maintenance skills which include repairing, adjusting, overhauling, tuning-up, maintaining, calibrating, etc.

These and some additional skill areas were identified by an analysis of certain chapters of the Dictionary of Occupational Titles. Repetitive tasks were identified and analyzed to obtain these lists and a more thorough examination would undoubtedly uncover other potentially transferable skills.

The above analyses were interesting indeed! It was quite notable that many of the more junior occupations appear to do nothing except cleaning, collecting and servicing. Transferability should be obvious.

#### OCCUPATIONAL MOBILITY AND OCCUPATIONAL SUBSTITUTABILITY

Few researchers have attempted to define these terms and usually only refer to occupational transferability. However, there are two quite different concepts involved which should be examined:

- Occupational Mobility. This refers to the possibility or actuality of a person, trained for one occupation, to move into another occupation, with little or no





additional instruction. It also refers to the movement of people from one occupation to another, who have never received any formal training in either occupation. Both the labouring class of occupations and people who have received university education such as a general BA could be examples of the latter.

- Occupational Substitutability. This refers to the possibility or actuality of governments and/or employers developing employment and training programs based on the notion of occupational mobility. At a simplistic level, it could be used to locate a pool of unemployed, trained for occupations A and B to fill vacancies in occupation X, where high under-employment exists. For example, if there is a shortage of machinists and a surplus of construction workers, governments and employers could look to the possibility of running a modified training program to convert the construction workers into machinists. At a more complex level, it could be used as a major training policy. If workers in Occupation A are known to be highly transferable to occupations D, E, F, G, H and I, then one specially designed training course might be used to replace seven training courses.

### OCCUPATIONAL MOBILITY

Occupational mobility can be studied in at least three different ways:

- Happenstance. Many research studies have been carried out to determine the actual occupational mobility that occurs and conclusions such as workers will change their occupations three, four or five times in their lifetimes have been reached as a result. These types of studies







have been reached as a result. These types of studies uncover what is happening in terms of occupational mobility but are unable to determine why it is happening (aside from obvious cases such as technological changes in industry) and do not further the possibility of actively making use of the potential for occupational mobility.

- Opinion Surveys. The studies carried out by the German Federal Manpower Commission and current studies being carried out in the Occupational and Career Analysis Division (OCAD) in CEIC determine the potential for mobility based on the opinions and beliefs of industry. They are important because they do find out what mobility the industries will currently permit. However, they do not find out why it should or should not happen and are much at the mercy of the opinions of the employers. The Germans found, for example, that miners were identified as an alternative occupation ONLY in areas where there were mines.
- Behavioural Surveys. Studies, such as the generic skills research, carried out intentionally to determine communalities of behaviours across occupations do not show what is happening in terms of occupational mobility. They do lend themselves to a more thorough understanding of the potential for mobility and to the development of relevant employment and training programs to enhance and extend the potential.

It appears obvious to the writer that all three types of research are important to meet the needs of the Employment and Immigration Commission.





## OCCUPATIONAL SUBSTITUTABILITY

Let us take another look at occupational substitutability. Everyone is aware of the current shortages in the machinists and tool and die occupations and of the programs which have been authorized in an attempt to entice more people into these trades. These programs are probably essential but they are costly and time-consuming because the existing system takes three to four years to produce qualified workers. It would also appear to be efficacious to take highly qualified people who are in trades with skill surpluses, identify their skill deficiencies in the shortage trades, and put them through a retraining program (Smith and Tansley, 1980). Let us look at Figure 2 which displays the percentages of tool skills held by a number of occupations as compared to the machinist trade. It appears obvious that it would take much less time to convert the people from surplus trades to the machinist trades, it would improve the individual versatility, and the skill deficiency would be met in much less time.

The German Federal Manpower Commission took a more comprehensive look at occupational substitutability. They produced a chart (reproduced on the two pages following Figure 2) which, in their words:

shows the various types of substitutive interrelationships: here we find, firstly, those occupations which, in the manner of "planets", have several "satellites" (e.g. metalworker, mason). Certain so-called "dead-end" occupations but which cannot, themselves, cover any other occupations. Finally, another phenomenon is manifested, to which reference could not previously be made, namely the substitution chains which result when several occupations are linked together as a result of substitutive interrelationship (e.g. industrial/commercial clerk - bank clerk - insurance agent). Such substitution chains may also



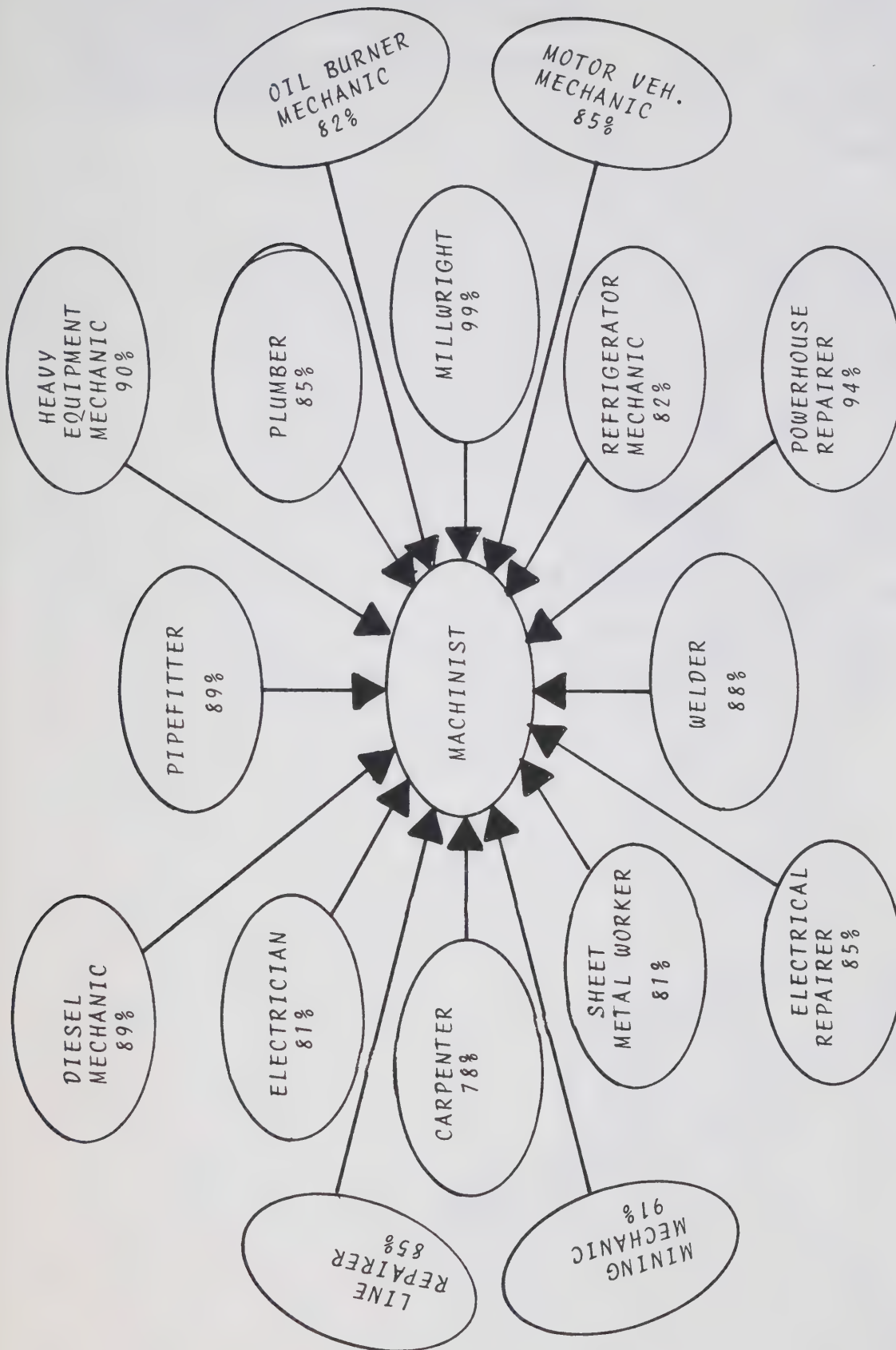
form a closed circle, as, for example, in the case metalworker - mechanic - toolmaker - metalworker, or: mason - concrete former - carpenter - mason. Substitution chains may also have the consequence that, at the outcome of various substitution processes, a situation of oversupply or of shortage will come to predominate in an occupation completely different from that in which it first made its appearance. Assuming that there existed a shortage of joiners, then part of this shortage could be compensated for by carpenters. The vacuum which then arises for the category "carpenter" could be filled by concrete formers and that for concrete formers could be filled by masons. A shortage of joiners would then make itself noticed, for example, as a shortage of masons. Whether such a chain reaction occurs depends on the wage differential, the differential for the other working conditions, as well as on social distance (degree of social affinity between the occupations).

The author is not terribly excited by some of the more theoretical possibilities of substitution chaining, but is excited about the prospect of planning more efficient training programs based on the notion of substitutability. If the German studies and the generic skills studies have validity, it appears reasonable to assume that fewer training courses would be necessary and that the graduates of these fewer courses would have greatly increased prospects for occupational mobility.

The author cannot leave this section without commenting on another aspect of occupational mobility. Although there is no research evidence to support the following, he well remembers in his youth (before the Second World War) when a large number of workers had certification in two or more trades and were accordingly quite versatile and occupationally mobile. It appears, that through the years the system has specialized workers to the degree that many

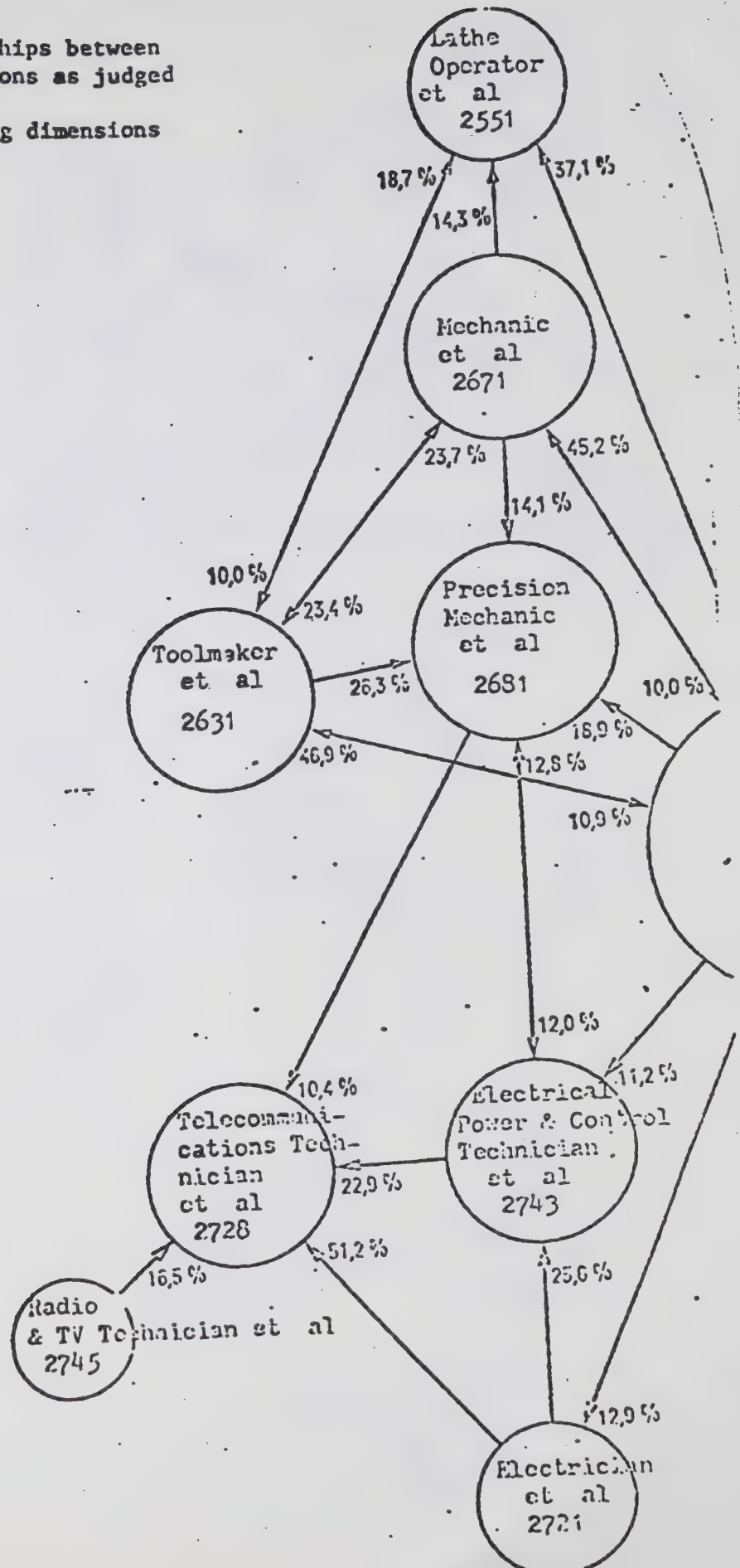




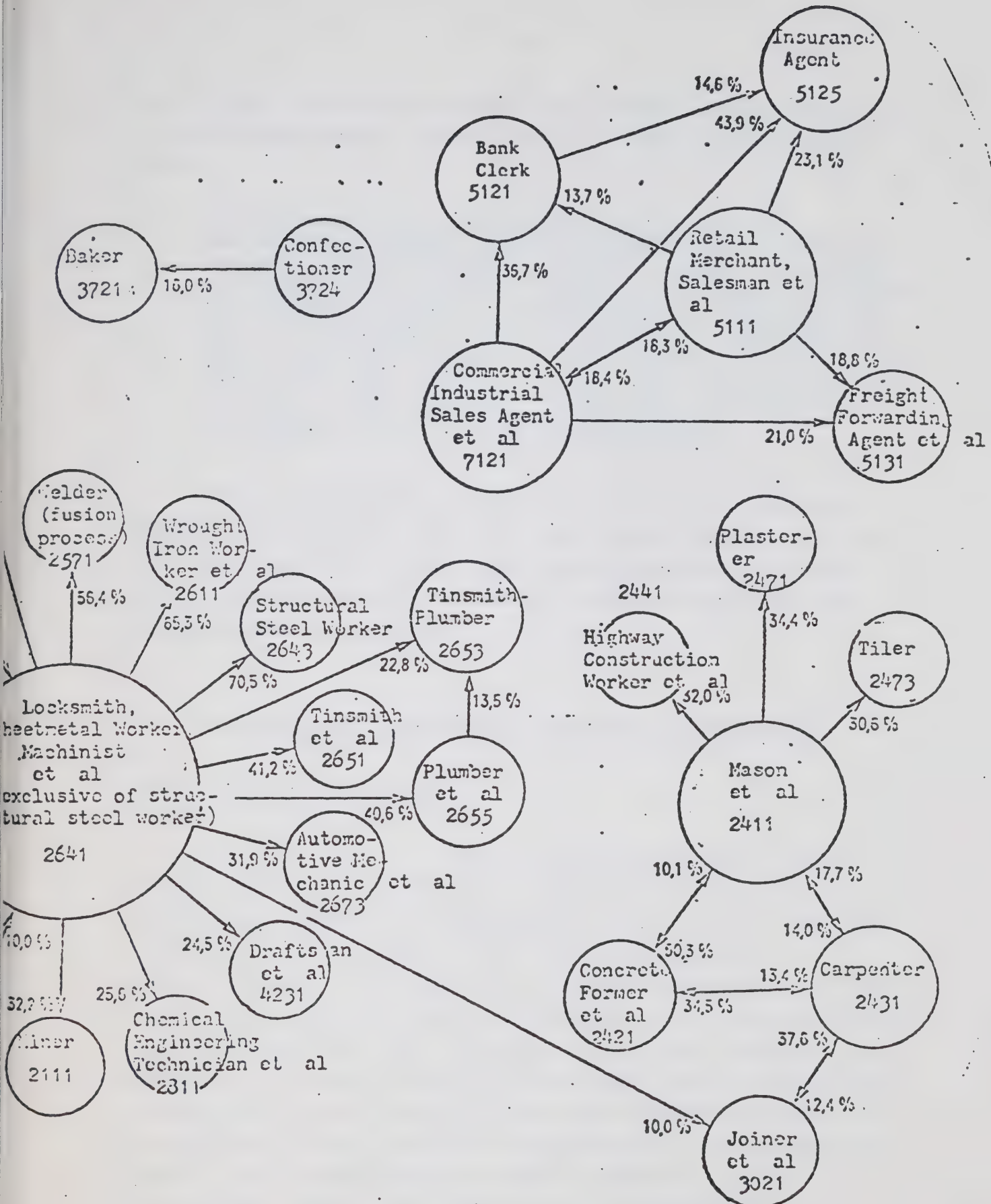




Substitutive interrelationships between individual skilled occupations as judged by superiors.  
(interrelationships assuming dimensions of 10% and greater)











are in fact, no longer occupationally mobile. As pointed out in a previous report, (Employment and Immigration Canada, 1978).

It is increasingly recognized that the rate of technological change, as well as the fluctuations of specific labour markets, requires a degree of training and flexibility possessed by relatively very few workers. The problem lies not in a resistance to change on the part of the labour force, but rather in the content of the curriculum which trains a person for a specific job rather than for a family of jobs, and the nature of the credentials for employment which fail to recognize, in this age of specialization, that many skills are transferable to a variety of occupations.

Occupational mobility can continue to be allowed to happen, in an unstructured and unsystemized manner, or the potential can be developed for the purposes of improving alternatives available to Canadian workers and hence the productivity of the nation.

#### OCCUPATIONAL CLUSTERING - SPURIOUS OR OTHERWISE?

#### OCCUPATIONAL DICTIONARIES

Historically, the various industries clustered jobs into the more abstract notion of occupations and then grouped occupations based on characteristics such as where the work was done or on the basis of what work was produced. Industries were concerned with issues such as control of the work force, hiring and wage remuneration. Career progression was recognized only for the normal industrial vertical promotional ladder: helper to trade and trade to supervisor. Subsequently, governments rationalized these industrial classifications and published comprehensive classifications such as the International Standard Classification of Occupations (ISCO), the United States Dictionary of



occupations (DOT), and the Canadian Classification and Dictionary of Occupations (CCDO). These documents tended to be committed to meet the needs of researchers, analysts and statisticians and had a much lesser commitment to meet the needs of career planning, education and training, and practically no commitment to the needs for occupational transferability, aside from the normal promotion on the job, such as to supervisory status. The relative priorities of the developers have been clearly articulated in the Introduction to the CCDO.

In fairness, it must be said that the CCDO's classification system is an improvement over either the ISCO or the DOT, in terms of being useful for career development programs. Nevertheless, it is primarily an industrial classification scheme (aside from the chapters dealing with professional and clerical occupations) and workers who use the same skills from different industries are unlikely to find themselves in the same occupational cluster.

Ohio State University published a critical analysis of the Socio-Economic Classifications (which would include the CCDO) (McKinlay, 1976). Amongst the findings were the following statements:

Socio-economic classification systems deal with a dimension that is not inherent in the work or the worker. They attempt to describe the status ascribed by society to particular occupations and to rank those occupations in accordance with the levels of status...

The implicit assumptions required to achieve a status ranking are worth noting. Theodore Caplow (1954) identified five: (a) white collar work is superior to manual work, (b) self-employment is superior to employment by others, (c) clean occupations are superior to dirty ones, (d) the importance of business occupations depend on the size of the business except in agriculture, and (e) personal service is degrading...These are not the topics that are most pertinent to educational planning, and there has recently been a rash of criticisms of existing occupational data from various users of the data...One of the basic instabilities is the fact that





that the entire population does not make consistent discriminations among like occupations. A major finding is that some occupations do not scale consistently because they are rated considerably higher by various population subgroups (Reiss, 1961)... Differences among specific occupations are perceived significantly only when the subjects classifying them are from similar occupations... Many classification systems imply that important differences among occupations are found only in the top few percent of the jobs. This tendency is perhaps a reflection of the points of reference of the systematizer rather than a fact of job and status. If so, it is disadvantageous for either educational planning or analysis of occupational transfers... The problem with socio-economic classification systems stems from a variety of conceptual and empirical weaknesses. Status is ascribed to rather than inherent in jobs and reflects several dimensions of work. The use of multiple dimensions, as in the Census and DOT, runs the risk of inconsistent weighting and, consequently, inconsistent groupings of occupations, whether the purpose is status ranking or not. To the extent that status is a motivating factor for people to change jobs or for employers to promote people (e.g., to positions of greater behavioral control), it is obviously one of the contextual determinants of mobility. But for curricular content of career education, it seems to obscure the essential similarities of the jobs themselves.

McKinlay has clearly pointed out that the socio-economic variables used in the occupational dictionaries are useful neither for educational planning or to determine occupational mobility. Superimposed on these problems is the author's belief that occupations were placed in the same groups because of the similarities of work produced or the location of the work - rather than in similarities of work behaviours. It is likely that a thorough examination of the work behaviours used by the workers would show markedly different relationships, as evidenced by the previously cited report Generic Skills Job Families and perhaps, rather more dramatically in another CEIC publication (Employment and Immigration Canada, 1979 c) which shows in chart form, the potential transferability of a number of craft trades within the traditional occupational families as well as across other



trade families. The shaftman/woman, for example, is classified with the miners in the occupational dictionaries (because that is where they work) but their work behaviour is much more akin to construction trades.

#### CAREER EDUCATION CLUSTERS

Because of the problems inherent in the classification systems, such as the DOT and the CCDO, a number of educational authorities have attempted to develop career education clusters. These have not been notably successful. The Ohio Studies, previously referred to, have had this to say about curriculum clusters:

While some good job analysis is done in these efforts, the desire to relate occupations and curriculum areas can lead to some confusion of the dependent and independent variables. Whereas the intent of vocational curricula is to relate education to the labour market, curriculum area classification systems propose to classify occupations in terms of the established areas of curriculum specialization. This approach makes the Procrustian error of attempting to fit the labour market to the existing educational structure. Thus, such a system contains the inherent danger of failing to describe the labour market so much as the institutional arrangement of schools. Another weakness of such a system is also illustrated here. Attempts are made to draw a distinction between academic subjects and vocational subjects, but no such distinction exists in the labour market. Such systems often go further in limiting the learning they consider to be relevant. By purporting to define the "teachable content" of jobs, they exclude sometimes necessary skills which are not judged to be "teachable" in a classroom setting...Another great weakness of such a system is the premise that immutable curricular requirements for occupations can be defined, while in fact there is great variety in the ways occupational preparation can and does occur. With the exception of regulated occupations where the means of entry into the occupation is restricted by force of law, a person can prepare for almost any occupation in a variety of ways...Whatever the system, it is as difficult and misleading to try to fit occupations into an



taxonomy as it is to try to subsume all education under occupational categories.

If, as the author of this monograph believes, and the research evidence from the studies from the Center for Vocational Education at Ohio State University clearly indicates, neither the existing industrial classification systems nor the existing Career Education Clusters are suitable for the development of a comprehensive program which would enhance occupational mobility and occupational substitutability, what is to be done? Should the CCDO be completely revised for these purposes? No! This is not the recommended solution. Industry needs a recognizable classification arrangement and the statisticians who carry out longitudinal and international comparison studies, would be frustrated. Robbing Peter to pay Paul is not the answer. The CCDO, regardless of the socio-economic status problems and the erroneous groupings of occupations, serves many extremely important purposes in its existing format.

#### COUNSELLING AND PLACEMENT CLUSTERING

The development of Volume 1 of the CCDO was a mammoth undertaking and one in which rather extensive improvements were made to the classification schemas used in ISCO and DOT. Because of the needs and desires of the various industries and the researchers and statisticians, the developers probably went as far as they could in terms of rationalizing the clustering arrangements. The serious mistakes were made in Volume 2 of the CCDO. This volume was designed to meet the following main objective, "to provide a useful instrument for career counselling and placement." Despite this primary objective all the clustering was based on the same groups as in Volume 1. No serious attempt was made to rearrange the





occupations to shown more than the traditional helper to trade to supervisor relationships. The key-punch operators, for example, were still shown with the other computer-related trades, despite the frequent movement from key-punch operator to typist (or reverse) and the infrequent movement from keypunch operator to computer operator. The personal service occupations N.E.C. (Not Elsewhere Classified) were left intact as a group, despite the obvious difficulties of ascertaining what might be common amongst tatoo artists, foster mothers and masseurs. Despite the obvious relationships between automotive mechanics and diesel mechanics they continued to be separated into different unit groups. The body repairers, with only a slight relationship, however, remained with the automotive mechanics. Aside from the dubious additional Qualifications Profiles (aptitudes, interests and temperaments) which were ascribed rather than measured, Volume 2 did not seem to provide much more relevant information than was already available in Volume 1 and it certainly did not make any attempt to provide a more useful method of clustering occupations for either counselling or placement purposes.

It appears obvious that no clustering arrangment based either upon the happenstance arrangement of jobs in industry or on the curriculum specialities in the educational system is likely to prove fruitful for counselling and placement programs. Nor will the analysis of the Qualification Profiles lend themselves to the preparation of improved clustering arrangements because of the problems of inaccurate or spurious status rankings. Even if they were accurate, their level of abstractness and generality do not lend themselves to curriculum decision making or to studies of occupational transferability. These problems make Volume 2 of the CCDO only partially useful for counselling and placement purposes.



## TRAINING CLUSTERS

It would appear that an assumption has been made that occupational groupings based on homogeneity of variables (be they Qualification Profiles, knowledge and skills, places of work, type of work done, or whatever) would also be the ideal arrangement for clustering of training requirements. Because of this apparent assumption, CEIC has never, aside from the generic skills studies, made any attempt to prepare clusters designed solely for training and training counselling. This is extremely unfortunate because the assumption is seriously flawed. Consider the teacher who is required to teach occupational mathematics in a BTSD program. He or she is not at all interested in whether occupations A, B and X are similar or dissimilar in any variables other than mathematics. Occupational educators and trainers are interested in one simple question, "Which students can be grouped for the attainment of which skills?". While it is true that occupations with high homogeneity of knowledge and skill requirements probably should be clustered for the purposes of training it may also be true that occupations with fairly low homogeneity may make ideal partners for training needs.

Let us examine some hypothetical data to understand this point. The matrices at Figures 3A and 3B show the skill requirements for eight occupations. Cluster analysis of these data would show that these eight occupations have an average communality of skills of 51% and no clustering program would ever place these occupations in the same family or group. Yet, when the occupations and skills are rearranged, as in Figure 3B, it can be observed that one would have a "perfect" training model.





FIGURE 3A - SKILL/  
OCCUPATIONAL MATRIX

		OCCUPATIONS							
		A	B	C	D	E	F	G	H
S K I L L S	1		✓	✓	✓	✓		✓	✓
	2		✓			✓	✓		✓
	3	✓						✓	
	4	✓			✓			✓	
	5	✓	✓	✓	✓	✓	✓	✓	✓
	6		✓	✓	✓	✓		✓	✓
	7	✓						✓	
	8	✓			✓	✓		✓	✓
	9			✓		✓	✓		✓
	10			✓			✓		
	11	✓	✓	✓	✓	✓	✓	✓	✓
	12	✓			✓			✓	
	13	✓			✓			✓	
	14	✓			✓	✓		✓	✓
	15	✓			✓	✓		✓	✓
	16			✓	✓	✓	✓		✓
	17			✓		✓			✓
	18			✓			✓		
	19	✓	✓	✓	✓	✓	✓	✓	✓
	20	✓						✓	
	21			✓			✓		

AVERAGE COMMUNALITY  
EQUALS 51%

FIGURE 3B - SKILL/  
OCCUPATIONAL MATRIX

		OCCUPATIONS							
		B	E	G	D	H	C	F	A
S K I L L S	5	✓	✓	✓	✓	✓	✓	✓	✓
	19	✓	✓	✓	✓	✓	✓	✓	✓
	11	✓		✓	✓	✓	✓	✓	✓
	1	✓	✓	✓	✓	✓	✓		
	16	✓	✓	✓	✓	✓	✓		
	6	✓	✓	✓	✓	✓	✓		
	9	✓	✓	✓	✓				
	2	✓	✓	✓	✓				
	17	✓	✓	✓	✓				
	21	✓	✓						
	18	✓	✓						
	10	✓	✓						
	3							✓	✓
	7							✓	✓
	20							✓	✓
	13					✓	✓	✓	✓
	4					✓	✓	✓	✓
	12					✓	✓	✓	✓
	14			✓	✓	✓	✓	✓	✓
	8			✓	✓	✓	✓	✓	✓
	15			✓	✓	✓	✓	✓	✓

RE-ARRANGED DATA TO SHOW  
AN IDEAL TRAINING MODEL

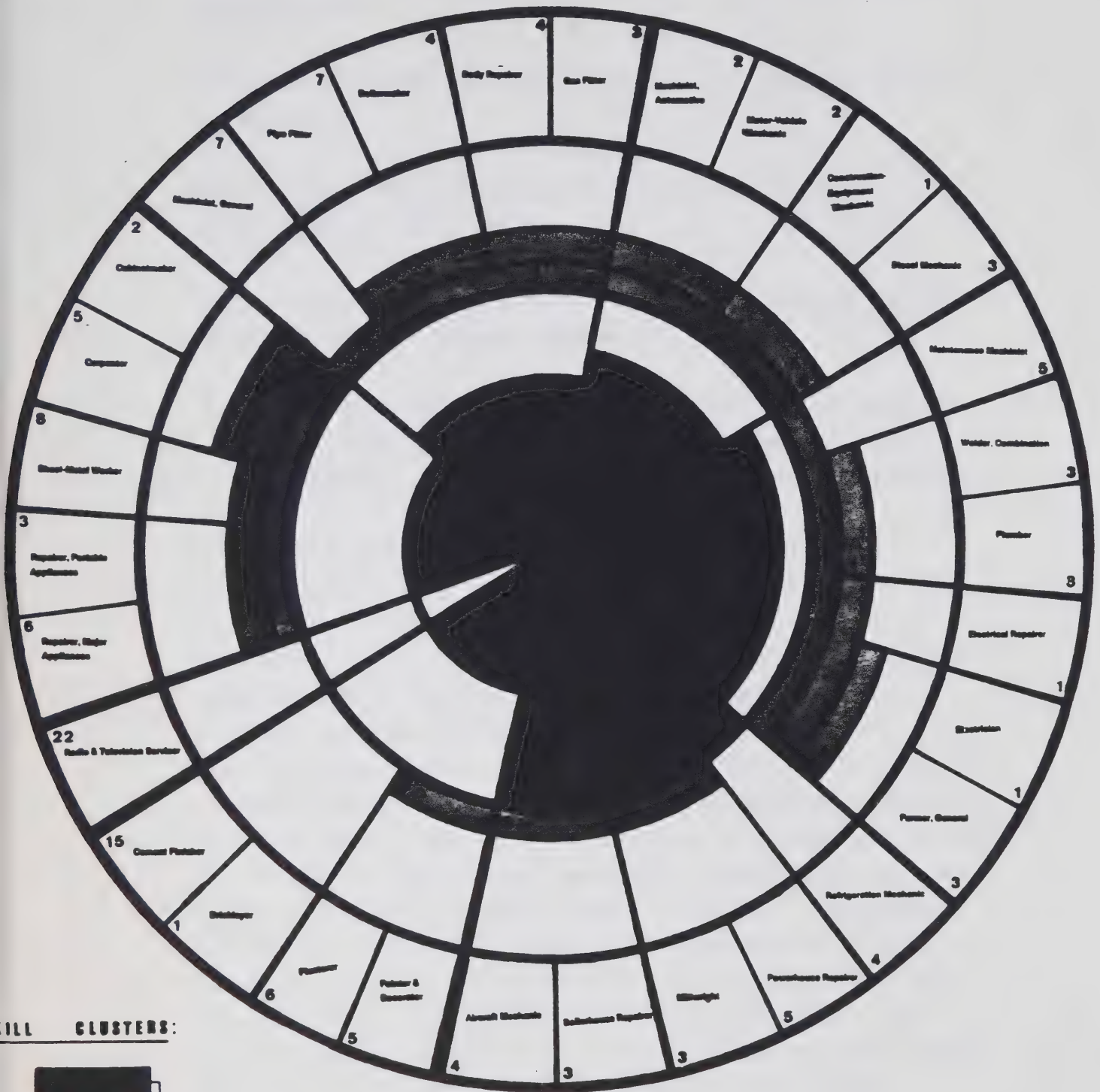
Obviously the data in Figures 3A and 3B have been "fabricated" and it is unlikely that any group of occupations as different as these could be so perfectly arranged for training purposes. Let us examine some real data from the CEIC survey of tool skills. At Annex 1 to this monograph is a two-page matrix of 30 occupations and 84 skills. The occupations are in alphabetical order and the skills in the same order which the data were collected. As a result of generic skills analyses of these data a revised matrix has been prepared and is shown at Annex 2. This in turn has been transposed into a Skill Training Model shown at Figure 4. A careful inspection of this figure will show that:



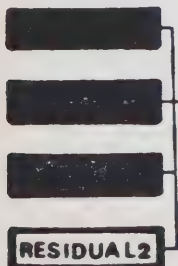
FIGURE 4

- 31b -

# SKILL TRAINING MODEL



ILL CLUSTERS:



Arthur De W. Smith  
Consultant  
Ottawa, Ontario  
1980





- 25 of the occupations have a common requirement for 44 core skills.
- 4 of the occupations have a common requirement for 11 core skills.
- 20 of the occupations have a common requirement for a major cluster of 13 skills.
- Many additional skills have been identified as major or minor cluster requirements.

The millwright and powerhouse repairer, as an example, share 72 skill requirements (out of those analyzed) and require respectively only 3 and 5 unique skill requirements.

- They could effect considerable efficiencies and economies by using the training cluster method in lieu of the one occupation-one instructor method. It is difficult, for example, to rationalize the purchase or development of expensive training methods if only required by the students of one training course - but when the requirement is for many students from a variety of training courses the expense or development time can be justified. Instructors, instead of being specialized by occupation would tend to become specialized by the types or groups of skills being imparted. It might inhibit the invidious practice of attempting to fill training seats for a particular occupational training course simply because the training organization has a specialized instructor who would be unemployed if there are no students for that particular occupational course.





- Training-counsellors would find it much easier to alter occupational goals for those students who had selected, or been selected for, a poor occupational choice.
- Students and instructors alike would find out that skills were being learned beyond those needed only for the chosen occupations. A set of attitudes dealing with potential occupational mobility would be developed, particularly if reinforced by a revised method of showing the skills attained in the occupational credentials.
- Training organizations would find it much easier to cater to revised occupational training requirements to meet changing labour market demands. As it now stands they need a rather lengthy time (one year plus) to obtain a specialized instructor and to develop the unique training program.

It should be realised that the model at Figure 4 is based upon incomplete data. Had all the data for these occupations from the tool surveys been used, the clusters of skills would necessarily have been different. And, of course, a model prepared from a comprehensive array of skills would result in vastly different sets of core skills and clusters of skills as well as different groupings of occupations. The model was prepared only to display the potential and the need for this type of analysis.

The model is not intended to show any form of homogeneity for those occupations which happen to end up together or nearby on the model. The farmer and the electrician are paired simply because they require many of the same tool skills. A model prepared for mathematical skills would probably show entirely different relationships.



### SUGGESTED CLUSTERING ARRANGEMENTS

The author of this monograph does not believe that one system of clustering can or should be developed to meet all needs. The designers of the CCDO in their attempts to meet the different needs of: census takers, researchers, analysts, statisticians, counsellors, placement officers, personnel officers, educators, and trainers, met all of them partly, and none of them well. The author does believe, however, that CEIC could establish one data bank from which different forms of analysis could be used to specifically prepare different clustering arrangements to meet the varying needs.

At a minimum CEIC should develop and promulgate the following types of occupational clustering arrangements:

- Homogeneity Clusters. Occupations should be clustered on the basis of homogeneity of behaviours (and other characteristics deemed important such as physical activities and environmental conditions). There are many computer programs which could be used for this purpose. Randhawa (1978) has described one method previously used to analyze generic skills. A somewhat simpler iterative process has been described in the previously cited report, Generic Skills Trade Families. If users such as the census takers and certain industries insist that occupations be treated together because they always have been rather than on a scientific treatment of measured variables a simplified CCDO at the four digit level could readily be prepared for their purposes. The primary objective of a dictionary of occupations should be to meet the mandate of CEIC: job placement, employment counselling, employment training and immigration.



• Counselling and Placement. Counsellors, placement officers and personnel officers do not need any information from CEIC when the client has a credential directly related to the job under consideration. They need to know how to relate a client with unrelated job history and unrelated training credentials to a specific job or type of job. Is the person trained or experienced in job M, in which no jobs are available, suitable or placement in occupation G? Should placement be exercised with or without a conversion training program? They need to know the relationship across occupational families as well as within these families. Counsellors advising students, or prospective students, need to know which skills and sets of skills are most productive for a wide range of occupations. Which occupational training courses are dead-ended and which would best prepare the students to be most occupationally mobile? And, of course, they need much of the type of concrete information already provided in the CCDO, such as licensing requirements. The writer foresees a number of ways these types of information could be analyzed and displayed. The Generic Skills Potential Transferability in the Craft Trades could readily be expanded to a larger variety of occupations to show potential placements. The development of Satellite Clusters, as used by the German Federal Manpower Commission (Institute for Labour Market and Occupational Research, 1977) is an interesting and useful approach to show these relationships. No counsellor or placement officer no matter how well-trained and experienced, can possibly know all the potential relationships between occupations. They need to know the relationships that are not so obvious because these form most of their daily workloads.





- Employment Training Policy. Members of CEIC, and their provincial counterparts, need to know which types of training have the highest payoff. Traditionally, numbers in the work force, economic projections for labour increases and decreases, and the capability of the training institutions are examined, and consequent decisions to purchase training seats for occupations A, M, S, T and U made. Of the thousands of occupations described in the CCDO, only a handful have occupational training courses subsidized by CEIC as institutional training contracts, but the greatest number are left to industry to provide the necessary formal or informal on-the-job training. The literature and research evidence is full of statements like, "Young people can expect to change their careers three, four or five times during their working lives." If these types of statements are accurate it would appear to behoove CEIC to purchase those types of training courses which best prepare their clients to adapt to career changes. Instead of only examining the data on job availability and job projections, the Commission should identify the occupational training courses which do in fact provide the greatest transferability potential. It is probably impossible, and certainly unrealistic, that the Commission should subsidize separate occupational training courses for each of the thousands of non professional occupations, but it should be possible and realistic for the Commission to identify and subsidize those training courses which would provide the basic knowledge and skills for entry into these thousands of occupations.

The Commission should depart from the policy of purchasing mostly one occupation-one training course, and embark on a policy of purchasing generalized courses which would fit Canadians for a variety of occupations.



Training Clusters. The federal Employment and Immigration Commission is responsible for employment and employment training. It therefore seems reasonable to assume that CEIC should be responsible for the collection, analysis and dissemination of all relevant occupational information. It is not realistic to expect an academic teacher responsible for trade mathematics, for example, to know what kind of mathematics is actually used by which trades people. Teachers responsible for programs, such as BTSD, can be expected to deliver occupationally relevant mathematics only if they know the specifics of the actual mathematical skills used. Measures such as GED, which is non specific, and grade levels, which were designed for young people in schools, are inappropriate for these purposes. Skill information would also be of great help to provincial educators responsible for vocational high school programs. Although the provinces are responsible for education, CEIC has the ultimate responsibility of placing the graduates into jobs. The development and dissemination of training models, as suggested in Figure 4, and the Secondary School Vocational Model (Employment and Immigration Canada, 1979 d), should greatly enhance training practices, without disturbing the role of the provinces vis-à-vis the federal government. The author has delivered hundred of seminars and workshops, at the request of the provinces, and has never once been asked any questions about why CEIC were involved in collecting and providing information on job knowledge and skills. He has been asked, countless times, why CEIC does not do more of it.

#### GENERIC SKILLS AND TRAINING

Of course, the craft trades need to be able to solve quadratic equations. Now let's get on with the job and decide the best processes to be used for teaching the algebraic processes.



The standards for entrance into this trade vary from Grade 8 to Grade 12 in different institutions, programs and provinces. What should be the correct standard?

But Mr. Smith, if we don't teach the periodic tables and the theories and terminology of the sub-atomic particles our vocational students will be ill-prepared for promotion on the job. We are not doing our jobs as educators if we only prepare people for first-level jobs.

We don't believe a lot of this academic nonsense that we borrowed from the school system is relevant to meet the needs of our adult up-grading students.

The above quotations, from an article Generic Skills (Smith, 1980) are illustrative of hundreds of conversations the author has had with educators and training administrators from British Columbia to Newfoundland. Employers, occupational associations, vocational schools, community colleges, provincial departments of education and labour and a host of other interested organizations have set a hodge-podge of entrance standards for the vocational trades. Little evidence of any research to deny or support these decisions could be found. There were some data indicating that students with higher grade levels tended to better than those with inferior grades, but this only seemed to prove the obvious - that success begets success. For these and other substantial reasons Training Research and Development Station, a former agency of the department, commenced the studies known as generic skills.

#### GENERIC SKILLS RESEARCH

The generic skills studies were designed to find the answer to three simple questions:

- Which skills are used by workers in which occupations?





- Which skills are transferable from one job or occupation to another?
- Which skills are needed for promotion to supervisory status?

Sequential studies were carried out to find out from workers and from their immediate supervisors, which skills are actually used in work performance. The first study only covered the skills of mathematics and communications and later studies covered skills of interpersonal behaviour, reasoning, science and tools. The information was obtained by showing workers lists of skills and asking them to check off those that are used on the job. Reliability data were obtained by obtaining the same information from the worker's immediate supervisor. Correlations between the two sets of data exceeded 0.95 which were indicative that reliable data were being obtained. To further ensure data reliability, the information was obtained from large and small employers and, where appropriate, from specialized and government employers.

The results of these studies have been promulgated in a number of reports and articles (many previously cited in this monograph). In summary the following information was discovered:

- Many of the skills taught in BTSD programs are NOT occupationally relevant. This is particularly true of the more esoteric topics in mathematics and in science. At one time, when CEIC was purchasing more BTSD programs, the author estimated that a reduction of science to only relevant skills would have saved approximately 20 million dollars a year.
- Many of the skills in interpersonal behaviours and in reasoning are occupationally relevant but are rarely taught or tested in programs such as BTSD.



- There are skill differences between trades and supervisors but most of these do NOT lie in the academic areas. Supervisors generally do not use more mathematics or science skills than do the workers they supervise. The supervisors do, however, need good communication skills and skills in the interpersonal and reasoning areas.
- Similarity of skill requirements across occupations is extremely high. Occupational mobility could be considerably enhanced if the time now taken to teach skills that are not occupationally relevant, were used to impart skills that are common requirements.

#### GENERIC SKILLS ADOPTIONS

In general it can be said that the concepts and data obtained in the generic skills studies have been accepted more by the provinces than by CEIC. Ontario and the Maritime Provinces have made extensive curricula changes as a result of the generic skills studies. The province of Quebec, despite the fact that no studies were carried out in that province, has used the data extensively to alter their vocational high school programs. Nova Scotia is currently installing a project to integrate BTSD and skill training in a program called, "Concurrent Generic Skills Training." The complete curriculum for one school in Edmonton has been revised to make their students more job ready. CEIC and provincial counsellors are using the information for their counselling programs. Yet, CEIC has made no attempt to use the concepts in the various occupational analysis programs and the author has seen no evidence of training policies being altered as a result of generic skills research. Hundreds of complimentary letters were received commending the generic skills studies but attempts to have the research



bolstered into a meaningful program came to naught. Since inception, the studies were primarily a one person program and when the author retired, person years could not be found to continue the program. This author could only assume that the generic skills studies were not deemed to be important enough to justify their continuation.

Internationally, there have been many adoptions of generic skills. In fact the first adoption of the data was in Redwood City, California, in a federally funded adult training program. England sent over a team of three researchers to investigate generic skills a number of years ago and as a result they are carrying out extensive studies to obtain data to revise their curriculum for early school leavers. The generic skills studies have been extensively written up in U.S. occupational research studies and as a result, most of the author's work since retirement, has been for the Americans. Within a few years it is anticipated that there will be more generic skills data and resulting programs in the United States and in England, than is available in Canada, where the concept was commenced.

#### OF BRIDGES AND BARRIERS AND OTHER ODDS AND ENDS

Any research and development studies dealing with the potential for occupational mobility and occupational substitutability must of necessity examine all factors which contribute to transferability (bridges) and the factors which inhibit transferability (barriers). Let's examine some barriers and bridges:

Bridges. Skills that are transferable across occupations, attitudes that make people know or believe that these skills are transferable, available information that shows the potential for transferability and systems that permit skills





to be transferred to alternative occupations are all positive bridges. Education and skill training programs that provide the necessary knowledge, skills and attitudes are positive bridges. Education and skill training programs that provide the necessary knowledge, skills and attitudes are positive forces unless they are channeld only in the narrow context of a single occupation.

Barriers. Unfortunately more seems to be known (or believed) about those factors that inhibit occupational transferability. Let's examine a few:

- a. Artificial Prerequisites. Employers, governments and training institutions frequently use artificial barriers which tend to inhibit both placement and subsequent transferability. A person who lacks a formal Grade 10 education, is all too often prevented from entering an occupation which may only require about six years of education to perform the occupational skills and occupational task as one article suggested (Employment and Immigration Canada, 1979 d):

Aside from the obvious requirements, such as entering students with sufficient reading comprehension to be able to understand their text books, the training institution's entrance requirements appeared to be more related to supply and demand than to any justifiable criterion. With dozens of Grade 12 students applying for placement in a specific training program the high school drop-out was given short shift, even in those cases where the job requirement did not require skills beyond those which would be developed by Grade 8. Insofar as the employer requirements were concerned, the rationale appeared to be bureaucratic: "All employees of this corporation must have Grade 12 - even the drivers and labourers;" or pedantic, "We promote from within - any of our hundreds of employees can become the president." One can almost imagine 100 truck drivers, all with university degrees, because one of them might eventually become the company president.



- b. Licenses. Usually the rationale used to license people to practice is based on arguments dealing with the necessity of protecting the public from incompetent services (sometimes they are used to protect a resource, such as commercial fishing licenses). Unfortunately, all too often the use of licenses ends up doing more to protect the people who are licensed than to protect the public. Much research in this area has been carried out, particularly in the United States, but unfortunately because of the numbers of agencies involved and the various jurisdictional areas, little has been done. Properly used, licenses should act as an inhibitor to prevent people from transferring into occupations for which they lack the competence to perform. Many have argued that they are used otherwise. One editorial from Business Week had these comments (Business Week, Nov. 1977):

In some states licensed workers make up a staggering 25% of the employed labor force, according to the U.S. Labor Department. But economists since the days of Adam Smith have viewed licensing as a form of monopoly that raises prices and increases unemployment by restricting the availability of services and jobs.

- c. Ignorance. The author suspects that the great inhibitor to occupational mobility is ignorance of the ability of people trained from one occupation to perform in another. It is indeed unfortunate that much of the work that has been done to classify occupations and to develop training programs has had the effect of reducing what was once known about occupational mobility.

Our forefathers, who had fewer training courses available to them, were in fact more occupationally mobile than are workers today. This is even true in





occupations which have had markedly little technolocial change, and in the construction trades, where improvements in technology have reduced the skill requirements. Plumbers once had to seal joints with poured lead, but anyone today could rather easily cut and install plastic pipes and drains, as is the current practice in that trade.

- d. Unions. To the degree that unions have insisted on union hall hiring practices to protect their own members and to the degree that unions have insisted that certain skills can only be practiced by their workers, they must bear part of the responsibility for decreased mobility.
- e. Training Programs. Although skill training programs have been cited as a postive help, they must, nevertheless, be cited as too often providing a barrier, both to entrance to an occupation and to occupational transferability. Whenever these programs insist that the prospective students meet artificially elevated entrance standards and whenever they insist that the students achieve skills and knowledge that are not occupationally relevant, any students who fail or drop out because of these unnecessary competencies, have been unfairly discriminated against. Whenever these programs teach skills only in the single context of a single occupation and do not teach common skills in a variety of contextual situations, they discriminate against occupational transferability. The generic skills studies in science Hatton and Smith, 1977) found:



Over 70% of the science behaviours now taught in the Academic Upgrading Science Program are either not used at all by any of the occupations surveyed or used by so few occupations (less than 10%) that they should only be taught within BTSD on a prescriptive basis or deleted from BTSD and included in the skill training programs.

Possibly the greatest disservice done in occupational programs is in the matter of attitudinal development. Vocational schools do teach skills which are transferable from one occupation to another, but they do not teach the students that these skills are transferable. Rather they give the graduates a certificate or diploma which certifies their competency in a single occupation and expect that their graduates should look for jobs only in the named occupation. If fact, I have heard training administrators complain when graduates obtain jobs in other occupations, as if something had gone seriously wrong.

- f. Apprenticeship Programs. Every time a new occupation is regulated under a government apprenticeship scheme there is a corresponding drop of skill transferability into the occupation. Apprentices are funded, controlled and trained by a variety of jurisdictions and, because most of the informal training on the job is directly controlled by the training and testing authorities, they have set extremely rigid time standards for qualification. The historical concept for apprenticeship, that apprentices can best learn from master journeymen is still sound. One should not, however, ignore the fact that people can and do learn skills in a variety of different ways and it is wrong to establish a system based only on the norm. It has been argued that these apprenticeship



plans are the responsibility of the provinces and CEIC has therefore no right to interfere. However, CEIC does fund the formal training aspects of these programs and should, therefore, have some rights to insist that the occupational requirements be valid. One has to wonder why it takes four to five years to produce a competent journeyman, when in far less time during the Second World War, Canada managed to recruit and train hundreds and thousands of competent workers. If apprenticeship programs had charge of recruitment and training for wartime, one would have to have at least four years between the declaration and the commencement of hostilities.

- g. Accreditation. As long as the various systems insist on giving graduates a piece of paper which certifies or acknowledges their training only for one specific occupation, and does not list or certify the competencies attained, it will remain difficult for counsellors and employers to relate the certificate to an occupation with some other name. CEIC has no control over certificates granted for provincial and school board jurisdictions, but should be able to influence the form of accreditation given for skill training programs subsidized by the Commission. The types of certification used by Holland College, which lists the actual skills (or tasks) which the student has attained, and which permits employers to endorse additional skill attainment or higher levels of the skills attained on the job, would greatly enhance the use of certificates. The movement by the Ontario Ministry of Colleges and Universities to use modular certificates is also a notable improvement. It should not be beyond human capability to develop a form of certification which has the capacity of





being kept up to date so that, as people acquire new skills, the certificate can reflect the skill changes.

h. Occupational Dictionaries. Despite the need for and the many accomplishments of occupational dictionaries such as the CCDO, they have inadvertently succeeded in showing an artificial distance between occupations. Let's take two examples:

- Motor-vehicle mechanic and diesel mechanic. There are far more similarities than differences between these two trades. But the fact that one is in unit group 8581 and the other in unit group 8584 leads people to the erroneous belief that there must be rather significant differences between the workers in these two trades.
- Carpenter and carpenter helper. As everyone knows progression from carpenter helper to carpenter is normal and expected. But if one were to examine the data for these two occupations as reflected by the CCDO one might wonder how such progression could be achieved. A carpenter helper is coded DPT: 684, GED: 2, SVP: 3, EC: B6, PA: M 2 3 4 while a carpenter is coded DPT: 361, GED: 4, SVP: 7, EC: B6, PA: M 2 3 4 7. Only the EC (Environmental Conditions) and PA (Physical Activities) have any communalities.



SUMMARY OF FINDINGS AND RECOMMENDATIONS

FINDINGS

Although it is well known that many, if not most, workers will change their careers several times during their working lives, the various systems of classifying occupations, counselling clients, placing clients into jobs or skill training programs and providing occupational credentials have been established as if each occupation is uniquely different from all other occupations. We know that the labour market is in a constant state of fluctuation but we do not prepare workers to adapt to these changes. We know that even in high periods of unemployment that many types of jobs are in an under-supply situation but we do not prepare clients who are out of work to take advantage of the jobs that are in demand. We know that the deficient occupations of today may be the surplus occupations of tomorrow, but we continue to train people as if they were going to remain in a single occupation the remaining days of their working lives. We invent systems such as job classifications, credentials, licenses and use only single contextual training which inhibits the natural aptitude of the human being to adapt to changing work conditions. While engineering technology is decreasing the skill requirements for a variety of occupations our systems technology is making it more difficult for people to enter these occupations.

We emerged from the period after the Second World War when Canadian workers were generally quite occupationally mobile. We only had a few vocational schools and community colleges which offered a handful of occupational training courses. We now have hundreds of training courses in hundreds of training institutions along with all the paraphernalia of entrance prerequisites, tests, credentials and so on which have inhibited occupational mobility.





Given time, one would wonder whether we might not develop an occupational training course for each occupation classified in the CCDO.

In our attempts to systematize occupational information and career counselling and training programs we have inadvertently but successfully made it more difficult for people to adapt to changing labour conditions. In effect the Canadian Employment and Immigration Commission has helped to develop a system which makes job placement more difficult.

Occupational training involves a number of jurisdictions who use different standards, different entry prerequisites and different training content. Despite the fact that CEIC has funded skill training programs to the tune of many billions of dollars, little attempt has been made to rationalize or standardize these practices. The Canada Employment and Immigration Commission, which should be the fountain of all knowledge about jobs, finds itself in a position where provincial educators dictate the skill content of occupational education.

CEIC will pay unemployment insurance to out-of-work construction workers while valiantly attempting to crank up training programs to entice young people into a three-to five-year training program for shortage trades. Little or no thought is ever given to the possibility of providing remedial training for the out-of-work people who may already have many or most of the deficient skills. Administrators of the training programs appear to act as if they believed that there is something unconstitutional about giving workers skills for a second trade.

CEIC developed an occupational classification system (the CCDO) which was primarily oriented to meet the needs of



census takers, statisticians and researchers. The needs of job placement, career counselling and training programs were given, at best, secondary consideration. The CCDO uses socio-economic status factors which have been proven to be scientifically suspect, and even if accurate, so abstract and generalized to be of only limited use for placement, counselling or training purposes.

CEIC developed a new concept, called generic skills, to assess occupational skill requirements and occupational transferability. The concept and data resulting from research studies has been much commended, nationally and internationally. Many of the provinces have made extensive curricula changes to occupational education as a result of these studies. CEIC and provincial counsellors have welcomed the approach as a practical method to assist in their career counselling practices. England has set up extensive task forces to extend the concept for their educational and training problems. The concept has been extensively described by occupational researchers in United States. Some people believe that the generic skills methodology will eventually replace the traditional forms of job and task analyses developed during the Second World War. Yet, CEIC has been unable to find the resources to continue these studies.

### RECOMMENDATIONS

Because the labour market is, and will continue to be, in a near constant state of fluctuation, all CEIC programs should be oriented to making workers adaptative to these changing conditions. The Commission should strive to make workers occupationally mobile and should actively work to remove any and all artificial barriers inhibiting occupational mobility.



The Commission should phase out the purchase of all occupationally specific skill training courses and concentrate, instead, on the purchase of skill training which prepares graduates for a variety of occupations. The transferability of skills learned should be a deliberate and specific objective of all instruction so that students are made aware of the multiple uses of their skills and abilities. The Commission should prepare the specifications for the skills and knowledge to be included in the training programs and leave the process of how they are to be taught or learned to the provincial and institutional educators and trainers. We should insist, for employment training programs, that the graduates be given certification for the skills and knowledge attained in a form and format suitable for job placement and hiring practices.

The Commission should gather occupational data using descriptors which are inherent in the work carried out by the worker. The use of abstract and generalized descriptors which are not useful for counselling, placement or training should be discontinued. Data on actual work behaviours, couched in terms understandable by all users of the data, should be collected for all occupations for which the Commission provides counselling, placement or training programs. The criteria for these data should be primarily oriented towards meeting the needs of the Commission.

Separate and specifically designed occupational clustering systems, resulting from analyses of occupational data collected, should be prepared to meet the following needs:

- Homogeneous clusters of occupations which have similar work behaviour requirements. Traditional census and industry practices should be ignored in the preparation of these clusters or occupational classifications. If





deemed necessary, modified forms of occupational classifications could be promulgated for the external users but the primary documents should be prepared ONLY to meet CEIC needs.

- Transferability charts, non-traditional movements across occupations based on similarities of work behaviours, satellite charts and other forms of clustering should be developed specifically to meet the needs of career counsellors and job placement officers.
- Training Clusters, specifically designed to determine common or core skills and other groupings of common skill requirements should be developed specifically to promote more efficiency and effectiveness in CEIC purchased training programs. Educators and trainers need to know which students can be grouped for the attainment of which skills and homogeneous groupings of occupations do not provide this answer.

Occupational mobility and occupational substitutability should become a primary objective of the Commission. Systems should be set up so that out-of-work skilled workers can automatically be matched to occupations requiring many similar skills, and where their skills are deficient, workers should have remedial training. Initial skill training should be concentrated in areas where the mobility will be the greatest.

Canada Employment and Immigration Commission should provide national leadership in the field of occupational education, including those areas in which the education is the sole mandate of the provinces. It is obvious that the provinces would not welcome any interference in their educational practices but, what is not so obvious, is the



fact that they do welcome information and analyses which help them do a better job.

Officials at all levels in the Commission must realize that people are not like machines. In this era of specialization and technology it may be reasonable to design a machine to carry out a unique job for its working life but we should be cautious about attempting to try to do this with people. Human beings are naturally much more adaptable than machines and it should be the aim of the Commission to build on this natural adaptability instead of attempting to force people into a single occupational mold.

Job placement, career counselling, employment training programs, immigration services and the provision of unemployment insurance are the primary objective delivery mechanisms of the Employment and Immigration Commission. In a simplistic way one could consider that full employment is the most desirable situation and many would-be-workers on unemployment insurance is the least desirable situation. If this were true, it should behove the Commission to obtain, analyze and disseminate information that would improve employment prospects and to provide the leadership and direction to remove all artificial barriers that inhibit employment.

This paper has addressed transferability of skills, as one vehicle to remove employment barriers.





OCCUPATIONAL/SKILL MATRIX	Aircraft Mech	Body Repairer	Boilerhouse Rep	Boilermaker	Bricklayer	Cabinetmaker	Carpenter	Cement Finish.	Hvy. Eqpt. Mech.	Diesel Mech	Elec. Repairer	Electrician	Farmer	Gas Fitter	Mach. Automat.	Maint. Mach	Machinist, Gen.	Millwright	Motor Veh. Mech	Painter	Pipe Fitter	Plasterer	Plumber	Powerhouse Rep.	TV Servicer	Refrig. Mech	App. Rep. Major	App. Rep. Port.	Sheet Metal Work	Welder, Comb.	PERCENTAGE	
Information from a survey of tool skills carried out by CEIC Canada of 1600 workers in 131 occupations.																																
Rulers and Tapes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	97
Scales, Engr/Arch	✓			✓		✓	✓										✓	✓		✓	✓		✓	✓					✓	✓	40	
Calipers	✓		✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓			✓		✓	✓	✓	✓	✓	73	
Micrometers	✓		✓	✓					✓	✓	✓				✓	✓	✓	✓	✓					✓		✓				✓	47	
Spirit Levels	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	90	
Transits																		✓			✓										7	
Squares	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓	✓	87	
Pitch/Angle Squares						✓	✓											✓			✓			✓					✓		20	
Bevel Protractors	✓			✓		✓	✓		✓	✓	✓	✓				✓	✓	✓						✓					✓	✓	40	
Drawing Tools	✓	✓	✓	✓		✓	✓		✓	✓	✓					✓	✓	✓		✓	✓		✓	✓					✓	✓	63	
Prec. Draw. Tools	✓		✓														✓	✓		✓											19	
Gauges	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓			✓	✓	✓	✓	✓	✓	87
Straight Hand Snips	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	90
Metal-Master ' Snip	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	80
Specialized Snips	✓	✓	✓				✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓			✓		63	
Bolt Cutters	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓		✓	✓		✓	✓		✓			✓		✓				✓	63	
Regular Pliers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
Vise Grips	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	93
Cutting Pliers	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	90
Special Nose Pliers	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	87
Utility Pliers	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	80
Tongs	✓		✓			✓			✓	✓					✓	✓	✓	✓								✓			✓		43	
Tweezers/Hemostats			✓						✓	✓			✓			✓	✓	✓						✓				✓			27	
Machinists Vises	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	✓	83
Carpenters Vises	✓		✓			✓	✓				✓						✓	✓	✓		✓										67	
Pipe Vises			✓	✓					✓		✓	✓	✓	✓		✓	✓	✓			✓		✓	✓		✓		✓			53	
C or G Clamps	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓		✓	✓		✓			✓	✓	77	
Pipe Clamps		✓	✓	✓		✓	✓	✓	✓	✓		✓				✓		✓						✓		✓			✓	✓	50	
Spring Clamps	✓	✓	✓	✓		✓			✓	✓			✓				✓	✓	✓		✓		✓	✓		✓			✓	✓	60	
Open-End Wrenches	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	90
Box Wrenches	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	✓	83
Combination Wrench	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓		✓	✓	✓	✓	✓	✓	83
Socket Wrenches	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓		✓	✓	✓	✓	✓	✓	87
Adjustable Wrenches	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	90
Nut Drivers	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓		✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	83
Pipe Wrenches	✓	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓		✓	✓	✓	✓	✓	✓	80
Torque Wrenches	✓		✓	✓					✓	✓	✓	✓	✓				✓	✓	✓		✓		✓	✓		✓	✓	✓				60
Hook/Pin Spanners	✓								✓	✓							✓	✓	✓				✓	✓		✓	✓			✓		47
Allen Wrenches	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	90
Common Screwdrivers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	97
Offset Screwdrivers	✓	✓				✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓		✓	✓	✓	✓	✓	✓	80
Ratchet Screwdriver	✓	✓	✓				✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓				70





	Aircraft Mech	Body Repairer	Boilerhouse Rep.	Boilermaker	Bricklayer	Cabinetmaker	Carpenter	Cement Finisher	Hvy. Eqp. Mech	Diesel Mech	Elec. Repairer	Electrician	Farmer	Gas Fitter	Mach. Automotive	Maint. Mach	Machinist, Genend	Millwright	Motor Veh. Mech	Painter	Pipe Fitter	Plasterer	Plumber	Powerhouse Rep.	TV Servicer	Refrig. Mech	App. Rep. Major	App. Rep. Portable	Sheet Metal Worker	Welder, Comb.	PERCENTAGE
Threading Machines	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	89
Pipe Threaders	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	80
Thread Restorers	✓	✓	✓	✓				✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓			73
Extractors	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	77
Tube/Pipe Cutters	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓			✓	70
Tube/Pipe Benders	✓	✓	✓	✓					✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓			✓	67
Reamers	✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓			✓	67
Flaring Tools	✓	✓	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓			✓	70
Claw Hammers	✓	✓	✓			✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓				80
Machine Hammers	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓	✓	✓	90
Soft Face Hammers	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓	✓	✓	80
Sledges		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓			✓	✓	77
Cold Chisels	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓				✓	✓	✓	✓	✓	93
Socket Chisels						✓	✓														✓					✓					30
Punches	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	87
Axes/Hatchets						✓	✓					✓	✓								✓	✓		✓			✓	✓	✓		23
Hack Saws	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	90
Wood Saws	✓		✓		✓	✓	✓			✓	✓	✓	✓	✓		✓	✓	✓			✓	✓	✓	✓		✓	✓		✓		63
Files	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓			✓		✓	✓		✓	✓	✓	✓	✓	87
Rasps		✓				✓	✓					✓	✓																		13
Sharpening Stones	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓		✓			✓		✓			73
Scrapers	✓	✓	✓	✓		✓	✓		✓	✓	✓				✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓			73
Abrading Paper	✓	✓	✓	✓		✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	90
Planes	✓					✓	✓					✓	✓													✓					20
Knives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	97
Propane Torches	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	80
Soldering Irons	✓	✓		✓					✓		✓	✓	✓		✓	✓	✓	✓	✓		✓		✓			✓			✓	✓	50
Elec. Solder. Irons	✓	✓	✓			✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	77
Elec. Solder. Guns	✓	✓	✓				✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓					✓	✓	✓	✓	✓		✓	63
Oxy/Acy Welders	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓		✓	✓		✓	✓	73
Electric Welders	✓	✓	✓	✓					✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓		✓	✓		✓			✓	✓	70
Putty Knives		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓			✓	✓				70
Trowels				✓		✓	✓					✓		✓						✓		✓	✓						✓		37
Paint Brushes	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	77
Spec. Paint Brushes	✓	✓	✓			✓	✓		✓	✓			✓	✓							✓		✓						✓	✓	43
Staplers			✓									✓							✓		✓					✓		✓	✓	✓	40
Rivetting Machines	✓	✓		✓		✓			✓	✓				✓	✓	✓		✓	✓		✓		✓			✓	✓	✓	✓	✓	67
Caulking Guns	✓	✓	✓			✓	✓					✓		✓	✓						✓		✓			✓	✓		✓	✓	57
Oscilloscopes										✓					✓				✓					✓	✓						17
Electric Drills	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	90
Elec. Sabre Saws	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓								✓		✓	✓		✓	✓		✓	✓	70
Elec. Circ. Saws			✓			✓	✓	✓	✓	✓	✓	✓						✓	✓		✓		✓			✓			✓	✓	50



CLUSTERS:																															
CORE																															
MAJOR																															
MINOR																															
		Aircraft Mechanic	Boilerhouse Repair.	Millwright	Powerhouse Repair.	Refrigeration Mech.	Welder	Plumber	Maint. Machinist	Electrical Repairer	Electrician	Farmer	Heavy Eqpt. Mech.	Diesel Mechanic	Machinist, Automat.	Motor Vehicle Mech.	Boilermaker	Pipe Fitter	Body Repairer	Gas Fitter	Machinist, General	Sheet Metal Worker	Carpenter	Cabinetmaker	App. Repairer Major	App. Rep. Portable	Bricklayer	Cement Finisher	Plasterer	Painter	Television Servicer
Rulers and Tapes																															
Calipers																															
Spirit Levels																															
Squares																															
Gauges																															
Straight Hand Snips																															
Metal-Master ' Snips																															
Regular Pliers																															
Vise Grips																															
Cutting Pliers																															
Special Nose Pliers																															
Utility Pliers																															
Machinist Vises																															
Open-Ended Wrenches																															
Box Wrenches																															
Combination Wrenches																															
Socket Wrenches																															
Adjustable Wrenches																															
nut Drivers																															
Pipe Wrenches																															
Allen Wrenches																															
Common Screwdrivers																															
Offset Screwdrivers																															
Ratchet Screwdrivers																															
Threading Machines																															
Pipe Threaders																															
Extractors																															
Claw Hammers																															
Machine Hammers																															
Soft Faced Hammers																															
Punches																															
Hack Saws																															
Files																															
Sharpening Stones																															
Scrapers																															
Abrading Paper																															
Knives																															
Propane Torches																															
Elec. Soldering Irons													</																		

KEY: ✓ Skill used in the occupation.





CLUSTERS:		Aircraft Mechanic	Boilerhouse Rep.	Millwright	Powerhouse Rep.	Refrig. Mechanic	Welder	Plumber	Maint. Machinist	Elec. Repairer	Electrician	Farmer	Hvy Eqpt Mechanic	Diesel Mechanic	Machinist, Auto.	Motor Veh. Mech.	Boilermaker	Pipe Fitter	Body Repairer	Gas Fitter	Mach. General	Sheet Metal Worker	Carpenter	Cabinetmaker	App. Rep. Major	App. Rep. Portable	Bricklayer	Cement Finisher	Plasterer	Painter	Telegrapher
CORE																															
MAJOR																															
MINOR																															
Electric Sabre Saws																															
Cold Chisels																															
Specialized Snips																															
Bolt Cutters																															
C or G Clamps																															
Spring Clamps																															
Torque Wrenches																															
Thread Restorers																															
Tube/Pipe Cutters																															
Tube/Pipe Benders																															
Reamers																															
Flaring Tools																															
Sledges																															
Oxy/Acy Welders																															
Electric Welders																															
Micrometers																															
Hook/Pin Spanners																															
Electric Soldering Guns																															
Putty Knives																															
Drawing Tools																															
Pipe Vises																															
Wood Saws																															
Electric Circular Saws																															
Tongs																															
Pipe Clamps																															
Caulking Guns																															
Scales Engr/Arch.																															
Transits																															
Pitch/Angle Squares																															
Bevel Protractors																															
Precision Drawing Tools																															
Tweezers/Hemostats																															
Carpenters Vises																															
Socket Chisels																															
Axes/Hatchets																															
Rasps																															
Planes																															
Soldering Irons																															
Trowels																															
Special Paint Brushes																															
Staplers																															
Oscilloscopes																															





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